WHAT IS CLAIMED IS:

1. A method of determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said method comprising:

immobilizing a first one of said proximal end and said distal end of said golf club shaft;

initiating vibratory motion of a second one of said proximal end and said distal end of said golf club shaft in each of a plurality of vibration planes, each lying at a respective angular position about said longitudinal axis;

for each of said vibration planes, measuring maximum out-of-plane displacement of said second one of said proximal end and said distal end of said golf club shaft;

analyzing said measured displacements; and

calculating from said analyzed measured displacements said preferred angular orientation.

2. The method of claim 1 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end.

3. The method of claim 1 further comprising mounting a reaction mass on said distal end prior to said initiating.

4. The method of claim 3 wherein said initiating comprises applying an impulse to said golf club shaft in a direction other than parallel to said longitudinal axis.

5. The method of claim 4 wherein said applying an impulse comprises:

displacing said distal end of said golf club shaft in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

6. The method of claim 5 wherein:

said displacing comprises attracting said reaction mass with an electromagnet; and

said releasing comprises deactivating said electromagnet.

7. The method of claim 1 wherein said initiating comprises applying an impulse to said golf club shaft in a direction other than parallel to said longitudinal axis.

8. The method of claim 7 wherein said applying an impulse comprises:

displacing said distal end of said golf club shaft in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

9. The method of claim 1 wherein said measuring comprises:

providing on said shaft at least two energy reflective surfaces at angles oblique to said vibration plane;

directing a respective energy beam at each of said reflective surfaces;

detecting a respective reflected beam reflected from each of said surfaces;

calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion; and

deriving said out-of-plane displacement from said calculated distances.

10. The method of claim 9 wherein said respective energy beam is a beam of electromagnetic radiation.

11. The method of claim 10 wherein said beam is a light beam.

12. The method of claim 11 wherein said beam is a laser beam.

13. The method of claim 9 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end; said method further comprising:

mounting a reaction mass on said distal end prior to said initiating; wherein:

said reflective surfaces are on said reaction mass.

14. The method of claim 1 wherein:

said analyzing comprises plotting said out-of-plane displacements as a function of angle about said longitudinal axis; and

said calculating comprises determining a pair of opposed minimum displacements; wherein:

a line connecting said opposed minimum displacements defines said preferred angular orientation.

15. A method of determining straightness of a golf club shaft, said shaft having a handle end and having a tip end for mating to a club head, said method comprising:

immobilizing said handle end of said golf club shaft and defining a longitudinal axis passing through said handle end and extending perpendicularly with respect to a plane perpendicular to said handle end;

determining a spring constant of said golf club shaft in a transverse bending mode; and

for each of a plurality of angles about said longitudinal axis:

displacing said tip end of said shaft transversely to, and by a predetermined distance from, said longitudinal axis,

measuring a restoring force during said displacing,

determining a difference between said measured restoring force during said displacing and an expected restoring force based on said predetermined distance and said spring constant, and

deriving from said difference and said spring constant a deviation of said tip end from said longitudinal axis at said angle.

16. The method of claim 15 further comprising plotting said deviations at said plurality of angles, thereby providing a visual representation of said straightness of said shaft.

17. The method of claim 16 wherein said determining said spring constant comprises:

initiating vibration of said shaft in said transverse bending mode;

measuring frequency of said vibration; and

deriving said spring constant from said frequency.

18. The method of claim 15 wherein said determining said spring constant comprises:

initiating vibration of said shaft in said transverse bending mode;

measuring frequency of said vibration; and

deriving said spring constant from said frequency.

19. A method of determining straightness of a golf club shaft, said shaft having a handle end and having a tip end for mating to a club head, said method comprising:

immobilizing said handle end of said golf club shaft and defining a longitudinal axis passing through said handle end and extending perpendicularly with respect to a plane perpendicular to said handle end; and

for each of a plurality of angles about said longitudinal axis:

initially displacing said tip end of said shaft transversely to, and by a first predetermined distance from, said longitudinal axis,

measuring a first restoring force during said initial displacing,

subsequently displacing said tip end of said shaft transversely to, and by a second predetermined distance from, said longitudinal axis,

measuring a second restoring force during said subsequent displacing, and

deriving, from said first and second restoring forces and said first and second predetermined distances, a deviation of said tip end from said longitudinal axis at said angle.

20. The method of claim 19 further comprising plotting said deviations at said plurality of angles, thereby providing a visual representation of said straightness of said shaft.

21. A method of determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said method comprising:

immobilizing a first one of said proximal end and said distal end of said golf club shaft;

initiating vibratory motion, in a plane, of a second one of said proximal end and said distal end of said golf club shaft;

measuring said vibratory motion by:

providing on said shaft at least two energy reflective surfaces at angles oblique to said plane,

directing a respective energy beam at each of said reflective surfaces,

detecting a respective reflected beam reflected from each of said surfaces,

calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and

deriving displacement of said shaft from said calculated distances;

analyzing said measured vibratory motion; and

calculating from said analyzed vibratory motion said preferred angular orientation.

22. The method of claim 21 wherein said respective energy beam is a beam of electromagnetic radiation.

23. The method of claim 22 wherein said beam is a light beam.

24. The method of claim 23 wherein said beam is a laser beam.

25. The method of claim 21 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end; said method further comprising:

mounting a reaction mass on said distal end prior to said initiating; wherein:

said reflective surfaces are on said reaction mass.

26. A method of determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal

end for attachment to a golf club head, said method comprising:

immobilizing said proximal end of said golf club shaft;

mounting a reaction mass on said distal end of said golf club shaft;

initiating vibratory motion, in a plane, of said distal end of said golf club shaft, by:

displacing said distal end of said golf club shaft by attracting said reaction mass with an electromagnet, and

deactivating said electromagnet;

measuring said vibratory motion;

analyzing said measured vibratory motion; and

calculating from said analyzed vibratory motion said preferred angular orientation.

27. Apparatus for determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said apparatus comprising:

means for immobilizing a first one of said proximal end and said distal end of said golf club shaft;

means for initiating vibratory motion of a second one of said proximal end and said distal end of said golf club shaft in each of a plurality of vibration planes, each lying at a respective angular position about said longitudinal axis;

means for measuring, for each of said vibration planes, maximum out-of-plane displacement of said second one of said proximal end and said distal end of said golf club shaft;

means for analyzing said measured displacements; and

means for calculating from said analyzed measured displacements said preferred angular orientation.

28. The apparatus of claim 27 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end.

29. The apparatus of claim 27 further comprising reaction means for mounting on said distal end.

30. The apparatus of claim 29 wherein said means for initiating comprises means for applying an impulse to said golf club shaft in a direction other than parallel to said longitudinal axis.

31. The apparatus of claim 30 wherein said means for applying an impulse comprises:

means for displacing said distal end of said golf club shaft in a direction other than parallel to said longitudinal axis; and

means for releasing said displaced distal end.

32. The apparatus of claim 31 wherein:

said means for displacing comprises an electromagnet for attracting said reaction mass; and

said means for releasing comprises means for deactivating said electromagnet.

33. The apparatus of claim 27 wherein said means for initiating comprises means for applying an impulse to said golf club shaft in a direction other than parallel to said longitudinal axis.

34. The apparatus of claim 33 wherein said means for applying an impulse comprises:

means for displacing said distal end of said golf club shaft in a direction other than parallel to said longitudinal axis; and

means for releasing said displaced distal end.

35. The apparatus of claim 27 wherein said means for measuring comprises:

at least two energy reflective surfaces on said shaft at angles oblique to said vibration plane;

means for directing a respective energy beam at each of said reflective surfaces;

means for detecting a respective reflected beam reflected from each of said surfaces;

means for calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion; and

means for deriving said out-of-plane displacement from said calculated distances.

36. The apparatus of claim 35 wherein said respective energy beam is a beam of electromagnetic radiation.

37. The apparatus of claim 36 wherein said beam is a light beam.

38. The apparatus of claim 37 wherein said beam is a laser beam.

39. The apparatus of claim 35 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end; said apparatus further comprising:

a reaction mass for mounting on said distal end; wherein:

said reflective surfaces are on said reaction mass.

40. The apparatus of claim 27 wherein:

said means for analyzing comprises means for plotting said out-of-plane displacements as a function of angle about said longitudinal axis; and

said means for calculating comprises means for determining a pair of opposed minimum displacements; wherein:

a line connecting said opposed minimum displacements defines said preferred angular orientation.

41. Apparatus for determining straightness of a golf club shaft, said shaft having a handle end and having a tip end for mating to a club head, said apparatus comprising:

means for immobilizing said handle end of said golf club shaft and defining a longitudinal axis passing through said handle end and extending perpendicularly with respect to a plane perpendicular to said handle end;

means for determining a spring constant of said golf club shaft in a transverse bending mode; and

means for, for each of a plurality of angles about said longitudinal axis:

displacing said tip end of said shaft transversely to, and by a predetermined distance from, said longitudinal axis,

measuring a restoring force during said displacing,

determining a difference between said measured restoring force during said displacing and an expected restoring force based on said predetermined distance and said spring constant, and

deriving from said difference and said spring constant a deviation of said tip end from said longitudinal axis at said angle.

42. The apparatus of claim 41 further comprising means for plotting said deviations at said plurality of angles, thereby providing a visual representation of said straightness of said shaft.

43. The apparatus of claim 42 wherein said means for determining said spring constant comprises:

means for initiating vibration of said shaft in said transverse bending mode;

means for measuring frequency of said vibration; and

means for deriving said spring constant from said frequency.

44. The apparatus of claim 41 wherein said means for determining said spring constant comprises:

means for initiating vibration of said shaft in said transverse bending mode;

means for measuring frequency of said vibration; and

means for deriving said spring constant from said frequency.

45. Apparatus for determining straightness of a golf club shaft, said shaft having a handle end and having a tip end for mating to a club head, said apparatus comprising:

means for immobilizing said handle end of said golf club shaft and defining a longitudinal axis passing through said handle end and extending perpendicularly with respect to a plane perpendicular to said handle end; and

means for, for each of a plurality of angles about said longitudinal axis:

initially displacing said tip end of said shaft transversely to, and by a first predetermined distance from, said longitudinal axis,

measuring a first restoring force during said initial displacing,

subsequently displacing said tip end of said shaft transversely to, and by a second predetermined distance from, said longitudinal axis,

measuring a second restoring force during said subsequent displacing, and

deriving, from said first and second restoring forces and said first and second predetermined distances, a deviation of said tip end from said longitudinal axis at said angle.

46. The apparatus of claim 45 further comprising means for plotting said deviations at said plurality of angles, thereby providing a visual representation of said straightness of said shaft.

47. Apparatus for determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said apparatus comprising:

means for immobilizing a first one of said proximal end and said distal end of said golf club shaft;

means for initiating vibratory motion, in a plane, of a second one of said proximal end and said distal end of said golf club shaft;

means for measuring said vibratory motion by:

providing on said shaft at least two energy reflective surfaces at angles oblique to said plane,

directing a respective energy beam at each of said reflective surfaces,

detecting a respective reflected beam reflected from each of said surfaces,

calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and

deriving displacement of said shaft from said calculated distances;

means for analyzing said measured vibratory motion; and

means for calculating from said analyzed vibratory motion said preferred angular orientation.

48. The apparatus of claim 47 wherein said respective energy beam is a beam of electromagnetic radiation.

49. The apparatus of claim 48 wherein said beam is a light beam.

50. The apparatus of claim 49 wherein said beam is a laser beam.

51. The apparatus of claim 47 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end; said apparatus further comprising:

a reaction mass for mounting on said distal end; wherein:

said reflective surfaces are on said reaction mass.

52. Apparatus for determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said apparatus comprising:

means for immobilizing said proximal end of said golf club shaft;

a reaction mass for mounting on said distal end of said golf club shaft;

means for initiating vibratory motion, in a plane, of said distal end of said golf club shaft, by:

displacing said distal end of said golf club shaft by attracting said reaction mass with an electromagnet, and

deactivating said electromagnet;

measuring said vibratory motion;

analyzing said measured vibratory motion; and

calculating from said analyzed vibratory motion said preferred angular orientation.

53. Apparatus for determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said apparatus comprising:

a clamp for immobilizing a first one of said proximal end and said distal end of said golf club shaft;

a vibration generator for initiating vibratory motion of a second one of said proximal end and said distal end of said golf club shaft in each of a plurality of vibration planes, each lying at a respective angular position about said longitudinal axis;

at least one sensor for, for each of said vibration planes, measuring maximum out-of-plane displacement of said second one of said proximal end and said distal end of said golf club shaft;

an analyzer for analyzing said measured displacements; and

a processor for calculating from said analyzed measured displacements said preferred angular orientation.

54. The apparatus of claim 53 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end.

55. The apparatus of claim 53 further comprising a reaction mass for mounting on said distal end.

56. The apparatus of claim 55 wherein said vibration generator applies an impulse to said golf club shaft in a direction other than parallel to said longitudinal axis.

57. The apparatus of claim 56 wherein said vibration generator comprises an actuator for:

displacing said distal end of said golf club shaft in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

58. The apparatus of claim 57 wherein said actuator:

attracts said reaction mass with an electromagnet; and

releasing said reaction mass by deactivating said electromagnet.

59. The apparatus of claim 53 wherein said vibration generator applies an impulse to said golf club shaft in a direction other than parallel to said longitudinal axis.

60. The apparatus of claim 59 wherein said vibration generator comprises an actuator for:

displacing said distal end of said golf club shaft in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

61. The apparatus of claim 53 wherein said sensor measuring comprises:

at least two energy reflective surfaces mounted on said shaft at angles oblique to said vibration plane;

a respective beam generator for directing a respective energy beam at each of said reflective surfaces;

a respective detector to detect a respective reflected beam reflected from each of said surfaces; and

a processor for calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and for deriving said out-of-plane displacement from said calculated distances.

62. The apparatus of claim 61 wherein said respective energy beam is a beam of electromagnetic radiation.

63. The apparatus of claim 62 wherein said beam is a light beam.

64. The apparatus of claim 63 wherein said beam is a laser beam.

65. The apparatus of claim 61 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end; said apparatus further comprising:

a reaction mass for mounting on said distal end; wherein:

said reflective surfaces are on said reaction mass.

66. The apparatus of claim 53 wherein:

said analyzer plots said out-of-plane displacements as a function of angle about said longitudinal axis; and

said processor determines a pair of opposed minimum displacements; wherein:

a line connecting said opposed minimum displacements defines said preferred angular orientation.

67. Apparatus for determining straightness of a golf club shaft, said shaft having a handle end and having a tip end for mating to a club head, said apparatus comprising:

a clamp for immobilizing said handle end of said golf club shaft and defining a longitudinal axis passing through said handle end and extending perpendicularly with respect to a plane perpendicular to said handle end;

an analyzer to determine a spring constant of said golf club shaft in a transverse bending mode; and

a deviation calculator for, for each of a plurality of angles about said longitudinal axis:

displacing said tip end of said shaft transversely to, and by a predetermined distance from, said longitudinal axis,

measuring a restoring force during said displacing,

determining a difference between said measured restoring force during said displacing and an expected restoring force based on said predetermined distance and said spring constant, and

deriving from said difference and said spring constant a deviation of said tip end from said longitudinal axis at said angle.

68. The apparatus of claim 67 further comprising a plotter to plot said deviations at said plurality of angles, thereby providing a visual representation of said straightness of said shaft.

69. The apparatus of claim 68 wherein said spring constant analyzer comprises:

a vibration generator for initiating vibration of said shaft in said transverse bending mode;

a frequency counter for measuring frequency of said vibration; and

a processor for deriving said spring constant from said frequency.

70. The apparatus of claim 67 wherein said spring constant analyzer comprises:

a vibration generator for initiating vibration of said shaft in said transverse bending mode;

a frequency counter for measuring frequency of said vibration; and

a processor for deriving said spring constant from said frequency.

71. Apparatus for determining straightness of a golf club shaft, said shaft having a handle end and having a tip end for mating to a club head, said apparatus comprising:

a clamp for immobilizing said handle end of said golf club shaft and defining a longitudinal axis passing through said handle end and extending perpendicularly with respect to a plane perpendicular to said handle end; and

a deviation calculator for, for each of a plurality of angles about said longitudinal axis:

initially displacing said tip end of said shaft transversely to, and by a first predetermined distance from, said longitudinal axis,

measuring a first restoring force during said initial displacing,

subsequently displacing said tip end of said shaft transversely to, and by a second predetermined distance from, said longitudinal axis,

measuring a second restoring force during said subsequent displacing, and

deriving, from said first and second restoring forces and said first and second predetermined distances, a deviation of said tip end from said longitudinal axis at said angle.

72. The apparatus of claim 71 further comprising a plotter for plotting said deviations at said plurality of angles, thereby providing a visual representation of said straightness of said shaft.

73. Apparatus for determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal

end for attachment to a golf club head, said apparatus comprising:

a clamp for immobilizing a first one of said proximal end and said distal end of said golf club shaft;

a vibration generator for initiating vibratory motion, in a plane, of a second one of said proximal end and said distal end of said golf club shaft;

a sensor for measuring said vibratory motion, said sensor comprising:

at least two energy reflective surfaces on said shaft at angles oblique to said plane,

a respective beam generator for directing a respective energy beam at each of said reflective surfaces,

a respective detector for detecting a respective reflected beam reflected from each of said surfaces, and

a processor for calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and deriving displacement of said shaft from said calculated distances;

an analyzer to analyze said measured vibratory motion; and

a calculator to calculate from said analyzed vibratory motion said preferred angular orientation.

74. The apparatus of claim 73 wherein said respective energy beam is a beam of electromagnetic radiation.

75. The apparatus of claim 74 wherein said beam is a light beam.

76. The apparatus of claim 75 wherein said beam is a laser beam.

77. The apparatus of claim 73 wherein:

said first one of said proximal end and said distal end of said golf club shaft is said proximal end; and

said second one of said proximal end and said distal end of said golf club shaft is said distal end; said apparatus further comprising:

a reaction mass mounted on said distal end; wherein:

said reflective surfaces are on said reaction mass.

78. Apparatus for determining a preferred angular orientation of a golf club shaft about a longitudinal axis thereof, said golf club shaft having a proximal end for gripping by a golfer and a distal end for attachment to a golf club head, said apparatus comprising:

a clamp for immobilizing said proximal end of said golf club shaft;

a reaction mass for mounting on said distal end of said golf club shaft;

a vibration generator for initiating vibratory motion, in a plane, of said distal end of said golf club shaft, by:

displacing said distal end of said golf club shaft by attracting said reaction mass with an electromagnet, and

deactivating said electromagnet;

a detector for measuring said vibratory motion;

an analyzer to analyze said measured vibratory motion; and

a calculator to calculate from said analyzed vibratory motion said preferred angular orientation.

79. For use with apparatus for determining a characteristic of a golf club shaft, said golf club shaft having a proximal and a distal end and a longitudinal axis, said apparatus having means for immobilizing said proximal end and for initiating vibration of said distal end using a magnet, and for measuring said vibration using at least two energy beams; a reaction mass for mounting on said distal end, said reaction mass comprising:

a body having a bore therethrough into which said distal end is inserted;

at least two surfaces at respective oblique angles relative to said longitudinal axis for reflecting said at least two energy beams; and

an additional surface aligned to engage said magnet.

80. A method of determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said method comprising:

immobilizing a first one of said proximal end and said distal end of said structural member;

initiating vibratory motion of a second one of said proximal end and said distal end of said structural member in each of a plurality of vibration planes, each lying at a respective angular position about said longitudinal axis;

for each of said vibration planes, measuring maximum out-of-plane displacement of said second one of said proximal end and said distal end of said structural member;

analyzing said measured displacements; and

calculating from said analyzed measured displacements said preferred angular orientation.

81. The method of claim 80 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end.

82. The method of claim 80 further comprising mounting a reaction mass on said distal end prior to said initiating.

83. The method of claim 82 wherein said initiating comprises applying an impulse to said structural member in a direction other than parallel to said longitudinal axis.

84. The method of claim 83 wherein said applying an impulse comprises:

displacing said distal end of said structural member in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

85. The method of claim 84 wherein:

said displacing comprises attracting said reaction mass with an electromagnet; and

said releasing comprises deactivating said electromagnet.

86. The method of claim 80 wherein said initiating comprises applying an impulse to said structural member in a direction other than parallel to said longitudinal axis.

87. The method of claim 86 wherein said applying an impulse comprises:

displacing said distal end of said structural member in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

88. The method of claim 80 wherein said measuring comprises:

providing on said shaft at least two energy reflective surfaces at angles oblique to said vibration plane;

directing a respective energy beam at each of said reflective surfaces;

detecting a respective reflected beam reflected from each of said surfaces;

calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion; and

deriving said out-of-plane displacement from said calculated distances.

89. The method of claim 88 wherein said respective energy beam is a beam of electromagnetic radiation.

90. The method of claim 89 wherein said beam is a light beam.

91. The method of claim 90 wherein said beam is a laser beam.

92. The method of claim 88 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end; said method further comprising:

mounting a reaction mass on said distal end prior to said initiating; wherein:

said reflective surfaces are on said reaction mass.

93. The method of claim 80 wherein:

said analyzing comprises plotting said out-of-plane displacements as a function of angle about said longitudinal axis; and

said calculating comprises determining a pair of opposed minimum displacements; wherein:

a line connecting said opposed minimum displacements defines said preferred angular orientation.

94. A method of determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said method comprising:

immobilizing a first one of said proximal end and said distal end of said structural member;

initiating vibratory motion, in a plane, of a second one of said proximal end and said distal end of said structural member;

measuring said vibratory motion by:

providing on said structural member at least two energy reflective surfaces at angles oblique to said plane,

directing a respective energy beam at each of said reflective surfaces,

detecting a respective reflected beam reflected from each of said surfaces,

calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and

deriving displacement of said structural member from said calculated distances;

analyzing said measured vibratory motion; and

calculating from said analyzed vibratory motion said preferred angular orientation.

95. The method of claim 94 wherein said respective energy beam is a beam of electromagnetic radiation.

96. The method of claim 95 wherein said beam is a light beam.

97. The method of claim 96 wherein said beam is a laser beam.

98. The method of claim 94 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end; said method further comprising:

mounting a reaction mass on said distal end prior to said initiating; wherein:

said reflective surfaces are on said reaction mass.

99. A method of determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said method comprising:

immobilizing said proximal end of said structural member;

mounting a reaction mass on said distal end of said structural member;

initiating vibratory motion, in a plane, of said distal end of said structural member, by:

displacing said distal end of said structural member by attracting said reaction mass with an electromagnet, and

deactivating said electromagnet;

measuring said vibratory motion;

analyzing said measured vibratory motion; and

calculating from said analyzed vibratory motion said preferred angular orientation.

100. Apparatus for determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end a distal end, said apparatus comprising:

means for immobilizing a first one of said proximal end and said distal end of said structural member;

means for initiating vibratory motion of a second one of said proximal end and said distal end of said structural member in each of a plurality of vibration planes, each lying at a respective angular position about said longitudinal axis;

means for measuring, for each of said vibration planes, maximum out-of-plane displacement of said second one of said proximal end and said distal end of said structural member;

means for analyzing said measured displacements; and

means for calculating from said analyzed measured displacements said preferred angular orientation.

101. The apparatus of claim 100 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end.

102. The apparatus of claim 100 further comprising reaction means for mounting on said distal end.

103. The apparatus of claim 102 wherein said means for initiating comprises means for applying an impulse to said structural member in a direction other than parallel to said longitudinal axis.

104. The apparatus of claim 103 wherein said means for applying an impulse comprises:

means for displacing said distal end of said structural member in a direction other than parallel to said longitudinal axis; and

means for releasing said displaced distal end.

105. The apparatus of claim 104 wherein:

said means for displacing comprises an electromagnet for attracting said reaction mass; and

said means for releasing comprises means for deactivating said electromagnet.

106. The apparatus of claim 100 wherein said means for initiating comprises means for applying an impulse to said structural member in a direction other than parallel to said longitudinal axis.

107. The apparatus of claim 106 wherein said means for applying an impulse comprises:

means for displacing said distal end of said structural member in a direction other than parallel to said longitudinal axis; and

means for releasing said displaced distal end.

108. The apparatus of claim 100 wherein said means for measuring comprises:

at least two energy reflective surfaces on said shaft at angles oblique to said vibration plane;

means for directing a respective energy beam at each of said reflective surfaces;

means for detecting a respective reflected beam reflected from each of said surfaces;

means for calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion; and

means for deriving said out-of-plane displacement from said calculated distances.

109. The apparatus of claim 108 wherein said respective energy beam is a beam of electromagnetic radiation.

110. The apparatus of claim 109 wherein said beam is a light beam.

111. The apparatus of claim 110 wherein said beam is a laser beam.

112. The apparatus of claim 108 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end; said apparatus further comprising:

a reaction mass for mounting on said distal end; wherein:

said reflective surfaces are on said reaction mass.

113. The apparatus of claim 100 wherein:

said means for analyzing comprises means for plotting said out-of-plane displacements as a function of angle about said longitudinal axis; and

said means for calculating comprises means for determining a pair of opposed minimum displacements; wherein:

a line connecting said opposed minimum displacements defines said preferred angular orientation.

114. Apparatus for determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said apparatus comprising:

means for immobilizing a first one of said proximal end and said distal end of said structural member;

means for initiating vibratory motion, in a plane, of a second one of said proximal end and said distal end of said structural member;

means for measuring said vibratory motion by:

providing on said shaft at least two energy reflective surfaces at angles oblique to said plane,

directing a respective energy beam at each of said reflective surfaces,

detecting a respective reflected beam reflected from each of said surfaces,

calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and

deriving displacement of said shaft from said calculated distances;

means for analyzing said measured vibratory motion; and

means for calculating from said analyzed vibratory motion said preferred angular orientation.

115. The apparatus of claim 114 wherein said respective energy beam is a beam of electromagnetic radiation.

116. The apparatus of claim 115 wherein said beam is a light beam.

117. The apparatus of claim 116 wherein said beam is a laser beam.

118. The apparatus of claim 114 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end; said apparatus further comprising:

a reaction mass for mounting on said distal end; wherein:

said reflective surfaces are on said reaction mass.

119. Apparatus for determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said apparatus comprising:

means for immobilizing said proximal end of said structural member;

a reaction mass for mounting on said distal end of said structural member;

means for initiating vibratory motion, in a plane, of said distal end of said structural member, by:

displacing said distal end of said structural member by attracting said reaction mass with an electromagnet, and

deactivating said electromagnet;

measuring said vibratory motion;

analyzing said measured vibratory motion; and

calculating from said analyzed vibratory motion said preferred angular orientation.

120. Apparatus for determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said apparatus comprising:

a clamp for immobilizing a first one of said proximal end and said distal end of said structural member;

a vibration generator for initiating vibratory motion of a second one of said proximal end and said distal end of said structural member in each of a plurality of vibration planes, each lying at a respective angular position about said longitudinal axis;

at least one sensor for, for each of said vibration planes, measuring maximum out-of-plane displacement of said second one of said proximal end and said distal end of said structural member;

an analyzer for analyzing said measured displacements; and

a processor for calculating from said analyzed measured displacements said preferred angular orientation.

121. The apparatus of claim 120 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end.

122. The apparatus of claim 120 further comprising a reaction mass for mounting on said distal end.

123. The apparatus of claim 122 wherein said vibration generator applies an impulse to said structural member in a direction other than parallel to said longitudinal axis.

124. The apparatus of claim 123 wherein said vibration generator comprises an actuator for:

displacing said distal end of said structural member in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

125. The apparatus of claim 124 wherein said actuator:

attracts said reaction mass with an electromagnet; and

releasing said reaction mass by deactivating said electromagnet.

126. The apparatus of claim 120 wherein said vibration generator applies an impulse to said structural member in a direction other than parallel to said longitudinal axis.

127. The apparatus of claim 126 wherein said vibration generator comprises an actuator for:

displacing said distal end of said structural member in a direction other than parallel to said longitudinal axis; and

releasing said displaced distal end.

128. The apparatus of claim 120 wherein said sensor measuring comprises:

at least two energy reflective surfaces mounted on said shaft at angles oblique to said vibration plane;

a respective beam generator for directing a respective energy beam at each of said reflective surfaces;

a respective detector to detect a respective reflected beam reflected from each of said surfaces; and

a processor for calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and for deriving said out-of-plane displacement from said calculated distances.

129. The apparatus of claim 128 wherein said respective energy beam is a beam of electromagnetic radiation.

130. The apparatus of claim 129 wherein said beam is a light beam.

131. The apparatus of claim 130 wherein said beam is a laser beam.

132. The apparatus of claim 128 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end; said apparatus further comprising:

a reaction mass for mounting on said distal end; wherein:

said reflective surfaces are on said reaction mass.

133. The apparatus of claim 120 wherein:

said analyzer plots said out-of-plane displacements as a function of angle about said longitudinal axis; and

said processor determines a pair of opposed minimum displacements; wherein:

a line connecting said opposed minimum displacements defines said preferred angular orientation.

134. Apparatus for determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said apparatus comprising:

a clamp for immobilizing a first one of said proximal end and said distal end of said structural member;

a vibration generator for initiating vibratory motion, in a plane, of a second one of said proximal end and said distal end of said structural member;

a sensor for measuring said vibratory motion, said sensor comprising:

at least two energy reflective surfaces on said shaft at angles oblique to said plane,

a respective beam generator for directing a respective energy beam at each of said reflective surfaces,

a respective detector for detecting a respective reflected beam reflected from each of said surfaces, and

a processor for calculating from said detected beams distances of said surfaces from one or more fixed locations during said vibratory motion, and deriving displacement of said shaft from said calculated distances;

an analyzer to analyze said measured vibratory motion; and

a calculator to calculate from said analyzed vibratory motion said preferred angular orientation.

135. The apparatus of claim 134 wherein said respective energy beam is a beam of electromagnetic radiation.

136. The apparatus of claim 135 wherein said beam is a light beam.

137. The apparatus of claim 136 wherein said beam is a laser beam.

138. The apparatus of claim 134 wherein:

said first one of said proximal end and said distal end of said structural member is said proximal end; and

said second one of said proximal end and said distal end of said structural member is said distal end; said apparatus further comprising:

a reaction mass mounted on said distal end; wherein:

said reflective surfaces are on said reaction mass.

139. Apparatus for determining a preferred angular orientation of a structural member about a longitudinal axis thereof, said structural member having a proximal end and a distal end, said apparatus comprising:

a clamp for immobilizing said proximal end of said structural member;

a reaction mass for mounting on said distal end of said structural member;

a vibration generator for initiating vibratory motion, in a plane, of said distal end of said structural member, by:

displacing said distal end of said structural member by attracting said reaction mass with an electromagnet, and

deactivating said electromagnet;

a detector for measuring said vibratory motion;

an analyzer to analyze said measured vibratory motion; and

a calculator to calculate from said analyzed vibratory motion said preferred angular orientation.

140. For use with apparatus for determining a characteristic of a structural member, said structural member having a proximal and a distal end and a longitudinal axis, said apparatus having means for immobilizing said proximal end and for initiating vibration of said distal end using a magnet, and for measuring said vibration using at least two energy

beams; a reaction mass for mounting on said distal end, said reaction mass comprising:

a body having a bore therethrough into which said distal end is inserted;

at least two surfaces at respective oblique angles relative to said longitudinal axis for reflecting said at least two energy beams; and

an additional surface aligned to engage said magnet.